ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Final Project

Group 18

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Introduction

The final project showcases a simulation of a generic festival involving various types of guests , places to visit.
The simulation is made possible using the gama-platform that runs on top of a java virtual machine.
The simulation features various types of guests like metalHead, photographer,
police , thief etc. and places pertaining to the mentioned guests for example
a live concert stage for the metal head.
It also depicts how these guests interact with each other at different places which leads to changes in their local happiness and drunk value and as a result the global happiness and drunk index varies heavily over time.

Local Setup

Clone the repo: https://github.com/Sanskar95/gama_codes

Run GAMA 1.7 and import ** as a new project. Press run_simulation to run the simulation. Note that no parameters are required to be configured to run the simulation.

Species and their interactions

Static Agents:

GamingArea

Pub

Studio

PoliceStation

ShadyArea

Stage

Dynamic Agents:

MetalHead

Interactions:

Photographer- A photographer contacts the metalhead via FIPA and asks him whether he wants a picture. MetalHead can either agree or disagree depending upon the skills of photographer. He then goes to the studio to collect his photos.
A metal head can also have an informal conversation with a nearby photographer based based on his skills.

Thief- If he finds that a thief is near him, he can have a communication with the thief and eventually might get robbed depending upon a random flag related to the thief.

```
MetalHead0 says Why are you so close? Answer or I will hit you!
Thief2 says Sorry
```

Police: Greets a policeman in different ways depending on the fact if the policeman has recently caught a thief.

```
MetalHead3saysHello Police
```

MetalHead: Communicates with other metal heads via FIPA asking them if they want to come to the stage where they can enjoy the concert together. Happiness may increase or decrease depending on the acceptance of proposal via FIPA.
After receiving a refusal from other metalhead, he decides to go the pub depending upon the trait "willingToGetDrunk" and get drunk, hence the local drunk value increases.

```
MetalHead2 receives phone call from:MetalHead3: Would you meet me atPub
MetalHead3 receives a answer from MetalHead2 with content No I do not want to meet you. Go alone
```

ChillPerson: Can initiate communication to a non-busy chill person in talk range ,how the communication developes depends on the place where they meet for instance:

In Pub: He can offer the chill person a drink which he can accept or refuse depending upon the "willingToAcceptDrink" trait, happiness and drunkMetric are decreased and increased on refusal and acceptance, respectively.

```
MetalHead3 saysDo you want a drink?
ChillPerson2 saysNo I don't want a drink?
```

At stage: He can offer the chill person a drink which he can accept or refuse depending upon the "willingToAcceptDrink" trait, happiness and drunkMetric are decreased and increased on refusal and acceptance respectively.

```
MetalHead3 saysDo you want to dance?
```

```
ChillPerson2 saysNo I don't want to dance?
```

ChillPerson

Interactions:

Photographer- A photographer contacts the ChillPerson via FIPA and asks him whether he wants a picture. ChillPerson can either agree or disagree depending upon the skills of photographer. He then goes to the studio to collect his photos.
He can also have an informal conversation with the photographer in range for a photo depending upon his generosity metric.

```
ChillPerson7 says Can you take my Photo?
Photographer7 says Yes of course, I use to send information to everyone
```

Thief- If he finds that a thief is near him, he can have a communication with the thief and eventually might get robbed depending upon a random flag related to the thief.

Police: Greets a policeman in different ways depending on the fact if the policeman has recently caught a thief.

```
ChillPerson0saysHello Police
```

MetalHead: Can initiate communication to a non-busy chill person in talk range, how the communication develops depends on the place where they meet for instance:

In Pub: He can offer the metal head a drink which he can accept or refuse depending upon the "willingToAcceptDrink" trait, happiness and drunkMetric are decreased and increased on refusal and acceptance, respectively.

ChillPerson:Can initiate talk with another non-busy chill person.It is to be noted that a chill person can turn bad depending upon a random flag. When a bad guy meets with a chill person he can start a fight with him depending upon the trait "willingToFight".
If he wins the fight , it will lead to an increment in the happiness value and decrement if he looses the fight.

Thief

Interactions:

Thief:- Can initiate a conversation with a non-busy fellow thief asking or offering financial help depending upon the current amount of money he possess. They can transfer the money to each other leading to increment and decrement in the money value for both of them respectively.

```
Thief6 says Hello, Do you want some financial help homie?
Thief2 says No thank you I have enough money
```

Police: Police can talk with the thief via FIPA. Police can either warn the thief or take him to the jail depending upon the money he posses and a catchThiefFlag.

```
Thief6^^^^^^^^^^^^^^^^POLICE SPOTTED!!!^^^^^^^^^^^^^^^^
```

A thief can rob a metal head or a chill person depending upon a random number
In the process if he spots a police , a communication is sent to the police about his location that leads to decrement in his happiness.

During the robbing action , if the thief feels that there in not enough money to rob , the plan is aborted
on the spot and happiness is decreased.
If the robbery is conducted successfully, money with the thief and his happiness is increased while the reverse happens with person has just been robbed.

```
Thief6$$$$$$$$$$Handle me your wallet$$$$$$$$$$$$$$$$

Wow that was a good heist !!!!!!!!!
```

Police

Interactions:

MetalHead: Can do an informal conversation with a nearby non- busy metahead , the conversation depends on the trait “wishToPatrol”, same holds true with conversation with a nearby non busy chill person.

```
Police8 says Why are you so over excited and disturbing?
MetalHead9 says I love the music
```

Police: Informal conversation with nearby police , can be related to gathering money from the shady area(based on the flag “shouldTakeMoneyFromOtherSource”) or just a simple greeting exchange.

ChillPerson: Informal conversation with the chil person that is based on the fact if the police man wishes to patrol or not.

```
Police3 says Why are you so sad?
ChillPerson0 says I have always been quiet
```

Thief: A police officer after receiving a fipa inform message goes to the thief location and interrogates him , he may take the thief to jail if he finds that he is carrying a greater amount of money.

```
&&&&I have doubt on you ,Show me your pockets&&&&&
```

```
&&&&&&&Remember,I have my eyes on you, its a warning&&&&&&&&&&
```

A police checks the current funds in a police station and sets his flag “shouldTakeMoneyFromOtherSource” i.e target point is set to shady area to get the money .If he has money greater than 0, the money is deposited to the police station and he goes back to patrolling.

Photographer

Interactions:

ChillPerson- Can take a picture of a nearby chill person based on the flag “willingToClickFlag” and inform him via FIPA to collect the pictures from studio.Same holds true for metal head as well
It is to be noted that the camera battery decreases by 1 after clicking a picture, when the battery reaches 0 , photographer needs to go to the studio to get it recharged.

```
Photographer8 I don't want to take photo of you. I just dont feel like doing it!
Photographer9 found a metal head
```

Police: Photographer gets hold of a nearby policeman and proposes via fipa for a free photograph, its up to the policeman to accept or reject the proposal.

```
Clicked the pic , you want it, its for free though?
```

Photographer: Greets a nearby photographer via FIPA and talks about how awesome and profitable the festival is.

Gamer

Interactions:

Photographer:A gamer can have an informal conversation with a nearby photographer based on his skills.

```
Gamer3 says You should take a Photo of me!
Photographer1 says I'm busy right now
```

Police: Greets a policeman in different ways depending on the fact if the policeman has recently caught a thief.

```
Gamer0saysHello Police
```

Thief- If he finds that a thief is near him, he can have a communication with the thief warning him not to come near or he may hit him.

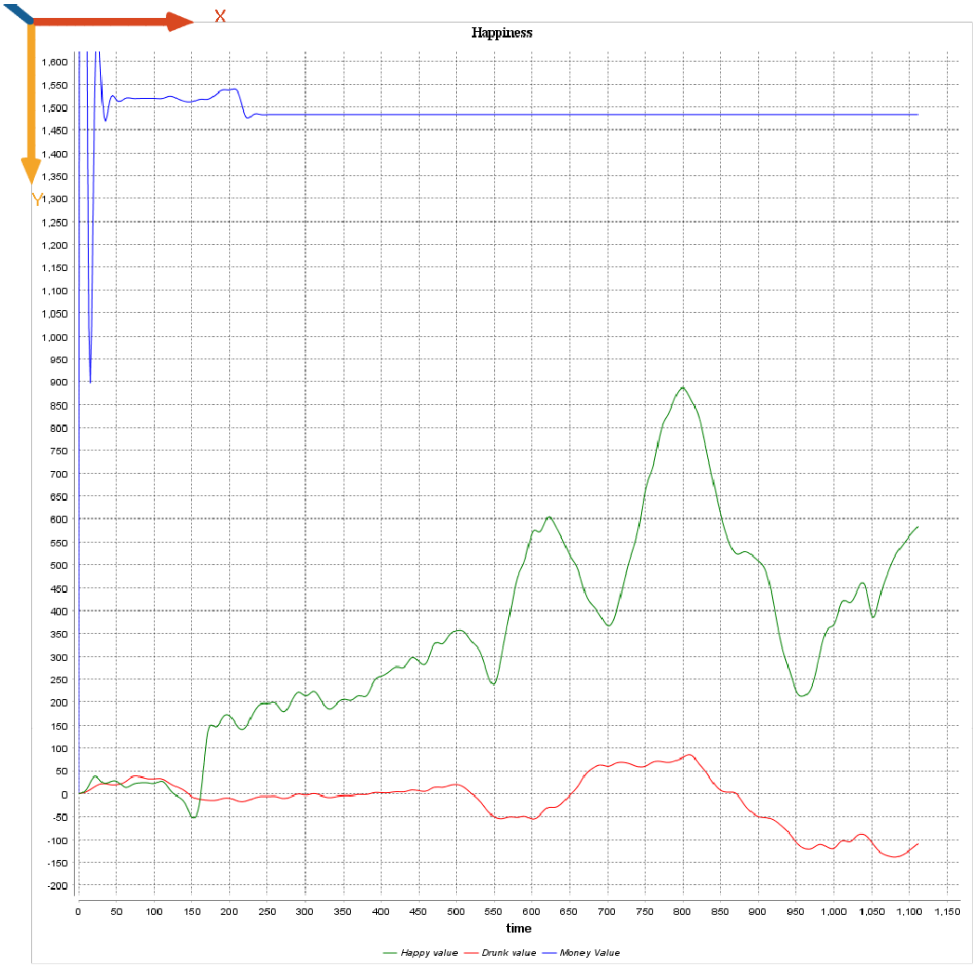
```
Gamer0 says Why are you so close? Answer or I will hit you!
Thief2 says Sorry
```

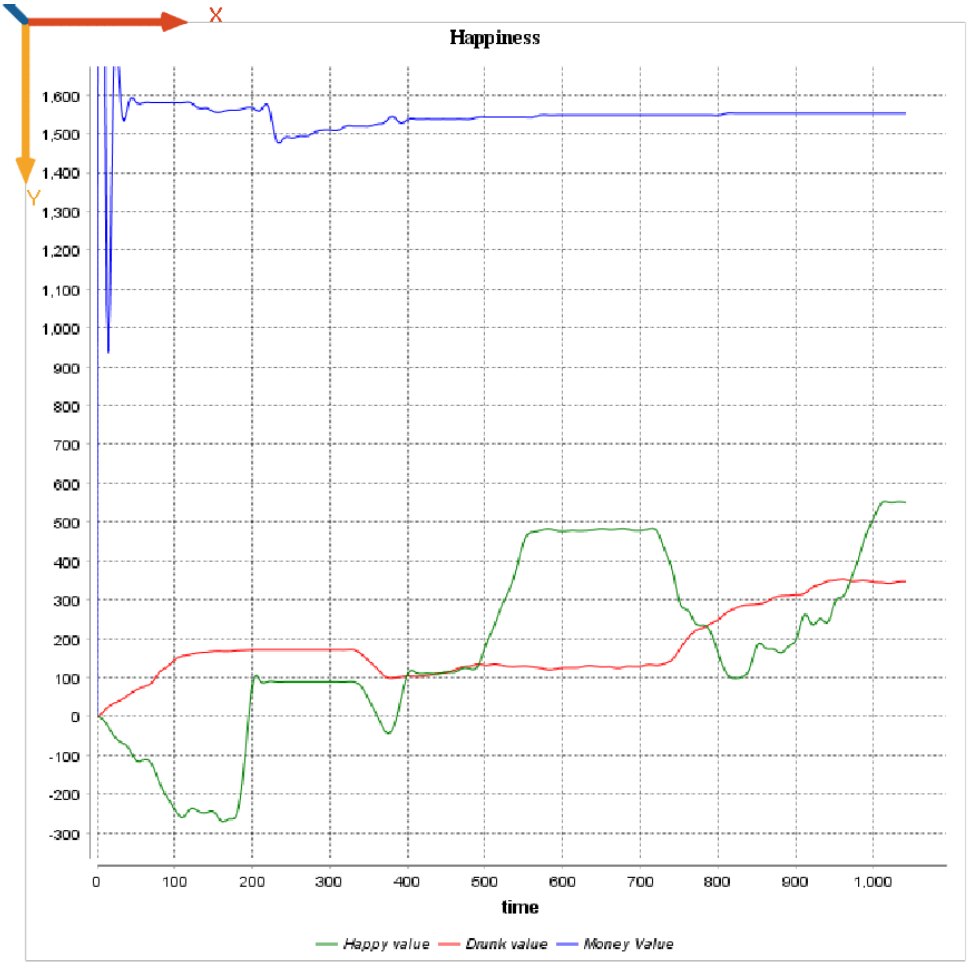
ChillPerson-Can start a conversation with a nearby chill guy and can challenge him for a game at the gaming area, if he finds that the chill guy is busy ,his happiness decreases and he then decides to get drunk based on the trait " willingToGetDrunk" and the local drunk metric increases , else both goes to the gaming area that lead to an increment in happiness for both of them.
Same interaction holds true for a nearby fellow gamer.

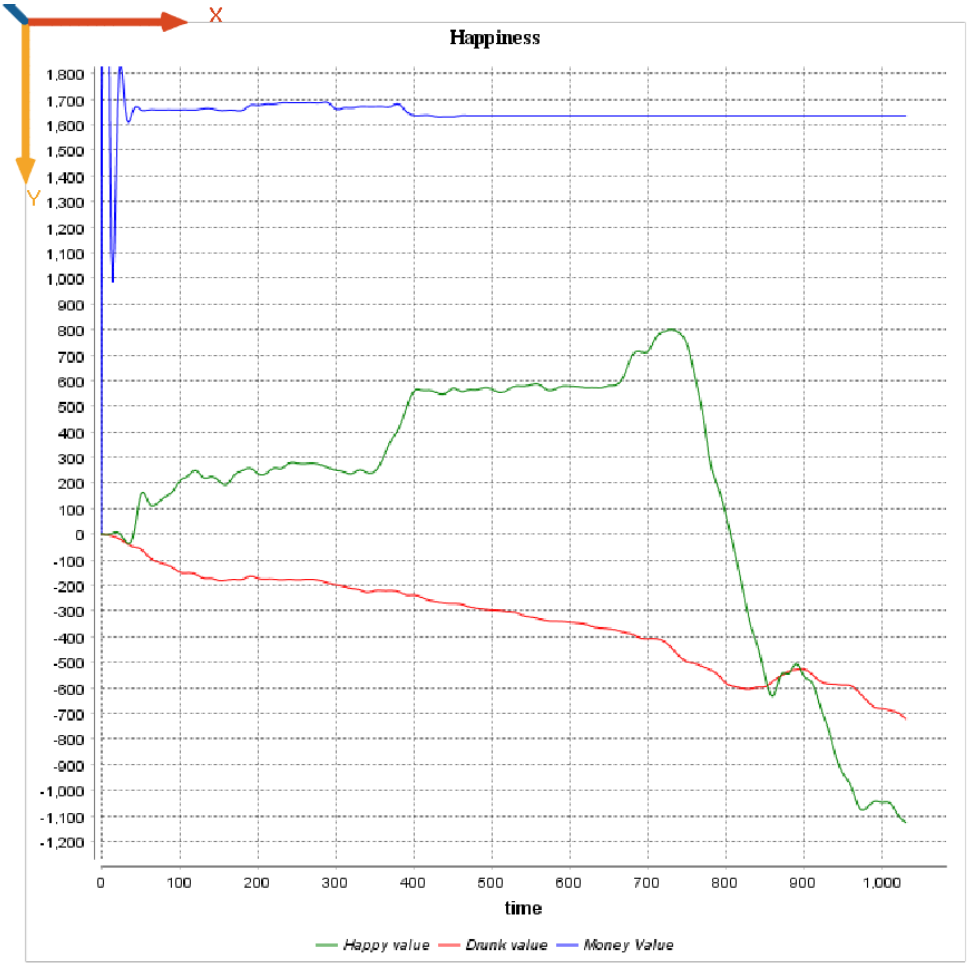
```
Gamer5 says Up for challenge at the gaming area ?
Gamer5 says You dont seem free , another day ,peace
```

Observations

Below are the results of experiment
The experiment is ran three times over a period of roughly 10 seconds and 1000 cycles







It can be observed that money value fluctuates for certain time and then becomes constant

There are multiple points where the drunk and happy value becomes equal

Also, it can be identified that happy value has more variation as compared to the drunk value.

The changes in the drunk value decreases over time while its hard to say about the happy value which is more unpredictable

Conclusions

As Gamer species is most prone to interactions with other species among all other species , hence changing the delta of happiness or drunk metric can significantly impact the overall global happiness and drunk metric variations.

Extra Assignment

The extra assignment focuses on the model of BDI(Belief-Desire-intention)
The belief–desire–intention software model (BDI) is a software model developed for programming intelligent agents. Superficially characterized by the implementation of an agent's beliefs, desires and intentions, it actually uses these concepts to solve a particular problem in agent programming. In essence, it provides a mechanism for separating the activity of selecting a plan (from a plan library or an external planner application) from the execution of currently active plans. Consequently, BDI agents are able to balance the time spent on deliberating about plans (choosing what to do) and executing those plans (doing it). A third activity, creating the plans in the first place (planning), is not within the scope of the model, and is left to the system designer and programmer.

- **Beliefs**: Beliefs represent the informational state of the agent, in other words its beliefs about the world (including itself and other agents). Beliefs can also include inference rules, allowing forward chaining to lead to new beliefs. Using the term *belief* rather than *knowledge* recognizes that what an agent believes may not necessarily be true (and in fact may change in the future).
    - **Beliefset**: Beliefs are stored in database (sometimes called a *belief base* or a *belief set*), although that is an implementation decision.

- **Desires**: Desires represent the motivational state of the agent. They represent objectives or situations that the agent *would like* to accomplish or bring about. Examples of desires might be: *find the best price*, *go to the party* or *become rich*.
    - **Goals**: A goal is a desire that has been adopted for active pursuit by the agent. Usage of the term *goals* adds the further restriction that the set of active desires must be consistent. For example, one should not have concurrent goals to go to a party and to stay at home – even though they could both be desirable.
- **Intentions**: Intentions represent the deliberative state of the agent – what the agent *has chosen* to do. Intentions are desires to which the agent has to some extent committed. In implemented systems, this means the agent has begun executing a plan.
    - **Plans**: Plans are sequences of actions (recipes or knowledge areas) that an agent can perform to achieve one or more of its intentions. Plans may include other plans: my plan to go for a drive may include a plan to find my car keys. This reflects that in Bratman's model, plans are initially only partially conceived, with details being filled in as they progress.
- **Events**: These are triggers for reactive activity by the agent. An event may update beliefs, trigger plans or modify goals. Events may be generated externally and received by sensors or integrated systems. Additionally, events may be generated internally to trigger decoupled updates or plans of activity.

  Source:https://en.wikipedia.org/wiki/Belief%E2%80%93desire%E2%80%93intention_software_model

In this assignment BDI is implemented on ChillPerson, MetalHead and a Gamer.

During the initialization of agents a desire “wants_to_do_something” is added.

A perceive block enables an agent to stop and have a conversation as a result all the desires beliefs and intentions related to going somewhere or to make a decision are removed.

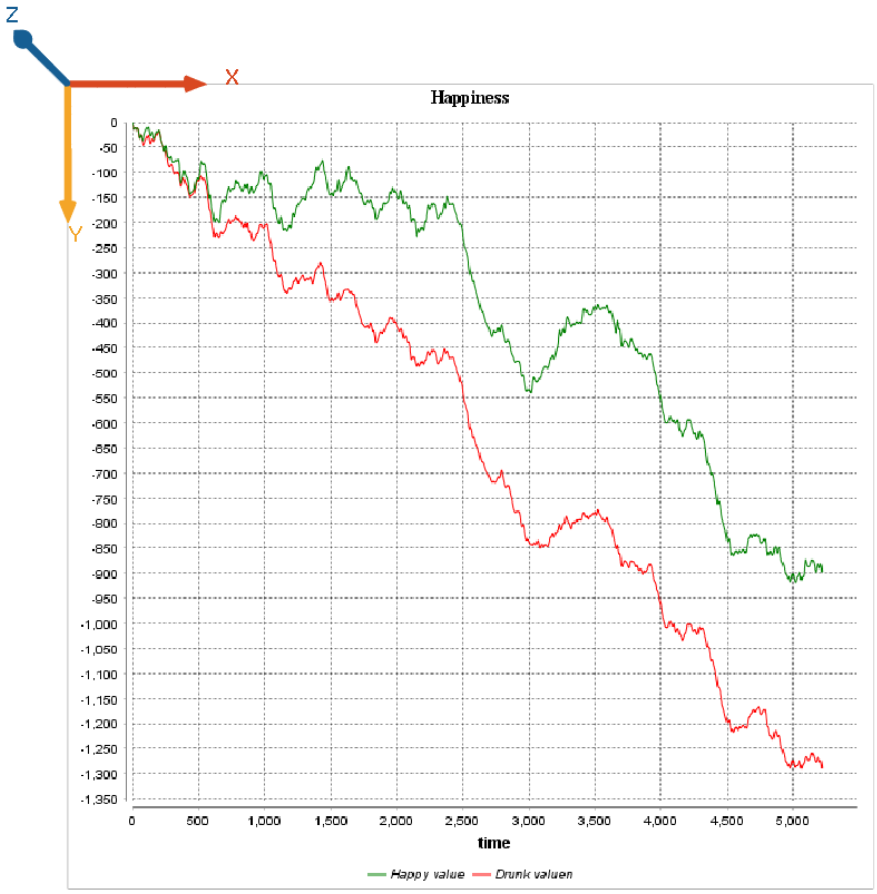
For a gamer though the desire “has_decided_where_to_go” exists , he only has 2 options to go i.e the gaming area or the pub depending upon the trait “willingToDrink” that results in increment or decrement in happiness and local drunk value accordingly.

A gamer can talk to a nearby gamer based on the fact that the gamer who he intends to talk to has same set of BDI values.

If he meets him at the pub , he may offer other gamer a drink where as if he meets outside an informal conversation takes place based on the trait “willingToSocializeWithOtherGamer”.

Both metalHead and chillPerson can either go to pub or the stage depending on a random number. The interactions are similar as implemented in the base assignment.

Global drunk and happiness value are monitored which are being updated on every iteration by gamer, metalhead and chillPerson.



Here it is observed that drunk value is always less than the happiness value , but bot follow a near similar trend .
This is attributed to the fact that both of these values are getting incremented or decremented at the same time or in the same branch of a condition.

For instance:
self.**happy**<-*self*.**happy**-5;
myself.**happy**<-*myself*.**happy**-5;
self.**drunk**<-*self*.**drunk**-1;
myself.**drunk**<-*myself*.**drunk**-1;

Conclusions:

Overall happiness and drunk index is largely impacted how frequent agents change their BDI values, for example keeping the priority high of talking to some other agent greatly impacts the

metrics as it restricts the agents to change their local happiness and drunk values as compared to the scenarios where agent actually decides on where to go.